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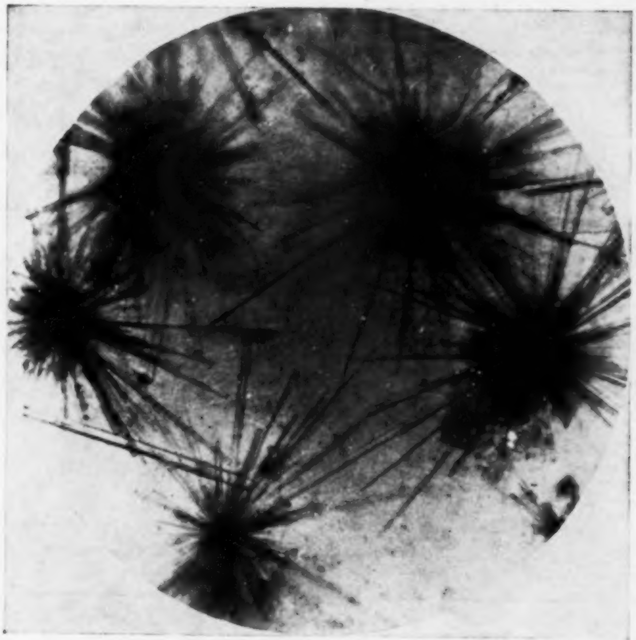

PHOTOMICROGRAPH OF MAGNESIUM SULFATE CRYSTALS
Courtesy Professor Karlem Riess. *(See Page 29)*

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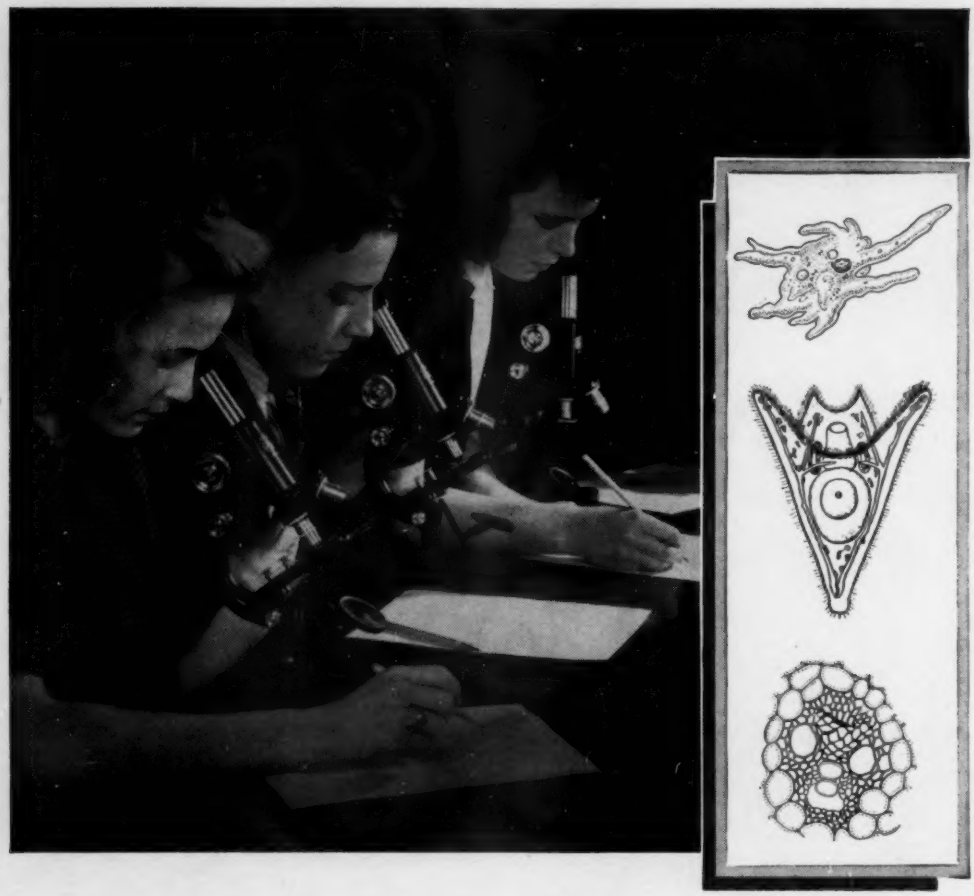


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THE SCIENCE TEACHER

Official Journal of

National Science Teachers Association

A Scientific and Professional Association

Associated with American Association for Advancement of Science
A Department of the National Education Association

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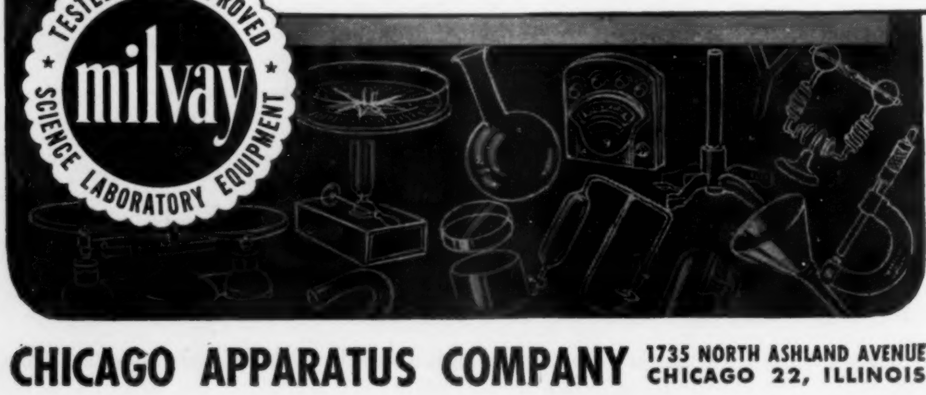

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The Science Teacher

VOLUME XII APRIL, 1945 NUMBER 2

Discussion of "Education for All American Youth"*

HARRY P. HAMMOND
Pennsylvania State College

I assume it is intended that my function in discussing "Education for *All* American Youth" is to indicate the views that engineers and engineering educators might be expected to hold with respect to that document. In order to indicate the grounds on which those views would be based it will be desirable first to give a general idea of the responsibilities that engineering education fulfills with respect to the profession it serves, and briefly to discuss the nature of the educational program employed to discharge those responsibilities.

In this connection, the obvious but fundamental fact must be kept in mind that the nature of an educational program preparatory to a professional career is largely fixed by external conditions to the educational process itself, that is, by those that are inherent in the profession served. In engineering, the basic external condition is the necessity of producing graduates having a background of attitudes and a foundation of knowledge, skills, and abilities such that they will be able eventually to occupy first-line technical and administrative positions in American industry and public affairs. And the necessity of producing such graduates rests, in turn, on the nature of our present day industrial economy and civilization. The general public has come to have confidence in the competence of engineers to discharge their professional duties and there is also increasing respect for their judgment on social problems. The training of engineering students must be such as to justify that confidence. We *can not* afford to produce a body of ill trained young engineers, and every part of the educational process must be scrutinized with that in view. Secondary education shares with collegiate engineering education the responsibility of seeing to it that only competent engineers and scientists are produced. Educators must shape the details of their programs so as to best accomplish their purposes, but the major objectives of sound professional disciplines based on adequate knowledge of fundamental laws, technical proficiency in their application, and a broad view of the function which their vocation serves in modern life, is not within their control. This fundamental fact has a definite bearing on the views that will be held by a professional group with respect to any document dealing with the educational process which is preparatory to service in that profession.

External conditions also fix the nature and scope of educational programs in engineering in more explicit ways. Their beginning level is established by the end point reached and the quality of work done in secondary schools. Their upper end is fixed by the responsibility accepted by engineering educators to produce graduates who have acquired adequate command of the principles of physical science and the techniques of mathematics; who can employ these principles and techniques in certain of the applied sciences, and who have been introduced to the "engineering method" of solving problems of practice. Engineering, like medicine is the *art* of applying science to practical situations: judgment, skill, an intuitive sense of the manner in which the solution of problems must be sought, appreciation of the element of values and costs, and, in a broad sense, understanding of economic factors and ability to deal with human relationships both

*An address by Harry P. Hammond, Dean of School of Engineering, Pennsylvania State College. Chairman, SPEE committee on Engineering Education. Delivered before the Middle States Association of Science and Mathematics Teachers at the Hotel New Yorker, New York City, November 25, 1944.

in respect to the working force through which projects are accomplished and in respect also to the population served, are comprised within the scope of that art. Engineering educators have accepted the obligation of developing among students an appreciation of the factors involved in the art of their calling and this also has an important influence in establishing the end point of the curriculum.

By tradition in part, but also by belief based on reason and analysis, the duration of the baccalaureate program in engineering is generally accepted as four academic years. The problem of colleges in engineering is therefore to produce the end result above defined in not longer than four years after completion of the twelfth grade. This is quite an assignment, particularly since it must be accomplished in spite of the rapidly expanding fields of science and technology. The educational program by means of which this must be done can carry no excess baggage of inert subject matter; it must be limited strictly to fundamental laws, the minimum of informational matter needed to put flesh and blood on the skeleton of principles, and essential mathematical tools and technical skills. It can ill afford to go any further downward into the realm of preparatory studies than is inescapably necessary.

In order to complete this general picture of engineering education, I would briefly summarize some of the features of the programs through which the objectives just defined are accomplished. In the first place, engineering is offered chiefly in undergraduate schools. Curricula may be considered as comprising two stages: a lower stage of the first two years, devoted chiefly to preparatory work in mathematics, the physical science, the verbal and graphical languages of English and drawing, and a few introductory technical subjects; and an upper stage, of the last two years, devoted to the applied mechanics of solids, fluids, heat, and electricity, certain more advanced technical skills, the application of physical principles and mathematical techniques to the solution of practical problems, and to a limited degree, to engineering specialties and electives. Curricula are also arranged in two major parallel sequences which it has recently been recommended extend throughout the four years. These are the scientific-technology stem of subject matter, and the humanistic-social stem. It has been recommended and a number of colleges are now moving in the direction of devoting approximately one-fifth of their programs to humanistic-social studies. Except in a small minority of cases, engineering curricula are not organized in separately administered junior and senior divisions, one preparatory to the other. They are organized as integrated wholes and have closely articulated structural form. Related courses follow each other in definite sequences which cannot be broken. An example is the sequence of mathematics, physics, mechanics, strength of materials, stress analysis, and structural design, which is the major sequence of the civil engineering curriculum. Students cannot jump to the upper stage of courses in framed structure without having a good working knowledge of stresses and deflections. This requires a sound understanding of m e c h a n i c s and strength of materials, which depend, in turn, on quantitative concepts of the principles of physics and command of the tools of mathematics. This stem has its roots in the work of the secondary school, where it is imperative that the foundations of knowledge, attitudes, thoroughness, and, broadly speaking, of scholarship must be laid if the student is to be started properly on the long path that leads ultimately to professional competence and thus to useful citizenship. What knowledge, skills, and attitudes would the engineering colleges like to rely on the secondary schools to produce in their entering students? This can be answered specifically for it is often discussed. First, they would like to have their students enter college with the ability to study effectively. They would like to have had them introduced to *quantitative methods* in such courses in science as they may have pursued. They would like to have them well grounded and drilled in algebraic operations. They would like to have them possess a fair conception of plane and spatial relationships acquired by the study of geometry and, if possible, they would like them to have had a first course in trigonometry. They would hope to have them reasonably proficient in reading, writing, and speaking the English language, though I think they are inclined to be tolerant in view of the difficulties of attaining this

goal. If the students could have had either or both physics and chemistry in high school, so much the better. Engineering educators would also feel that no student should leave the secondary school without some conception of the democratic mode of life and of the republican form of government established in this country to sustain it.

If the limitations of present conditions be ignored, what would engineering educators set up as an ideal basis of preparation for entry to their curricula? This is a pleasant subject on which to indulge one's imagination. I would answer the question as follows: In the secondary school a first-class counseling system would have encouraged those students, and only those to follow an engineering curriculum who had well above average intelligence and ability to work hard, who had demonstrated capacity to deal quantitatively with physical concepts and scientific principles, and who, especially were proficient in mathematics and liked to study it. These students, who would normally be found in the top third of graduating classes, would have pursued, under guidance, a solid sequence of courses in mathematics, including elementary, intermediate, and advanced algebra; plane and solid geometry; and plane and spherical trigonometry. Expressed in another way, these students would be prepared to start at once in college the study of calculus and analytical geometry, including differential equations, which they would complete in not more than three semesters. These students would have had sound introductory work in physics and chemistry, given in regularly organized courses and not picked up in "common learnings" or incidental to vocational work.

These courses would include some solid, quantitative treatment of the subjects, and would include laboratory exercises in problem solving. The students would come so well prepared in English the college would not need to give review courses in grammar, spelling, and the simple mechanics of sentence and paragraph structure. I admit freely, of course, that this would approach the millenium in view of the way students hear English spoken out of school. The students would also have had a good introduction to the study of American history and institutions with much more attention devoted to the significance of scientific discovery and industrial development than is given in the traditional type of history courses. Finally, and of equal importance, the students would enter college in sound health, with vigorous bodies and minds, and with some knowledge of how to take care of them.

On such a foundation, very significant and beneficial changes could be made in the content and organizations of engineering curricula.

All of this is a "consummation devoutly to be wished." Is it beyond attainment? I believe it can and should be attained. And the end to be achieved, as measured by its social significance, justifies its attainment. I would say with all the force I can command on behalf of the engineering colleges and the engineering profession that it should be made an explicit objective of secondary education in the period of development that is immediately ahead.

I presume that most of this audience has read the document to which these remarks relate—the recently published statement of the Educational Policies Commission entitled "Education for *All* American Youth." I had the privilege of reviewing it before publication and I have since read it again. It is an important document in relation to the key division of public education in this country, that is, the secondary schools.

Before I discuss the question of preparation for engineering education that would be afforded under the proposals of this document, I should like to say that it constitutes a very interesting contribution to educational literature. It presents convincingly a number of constructive proposals with which I, for one, am in hearty agreement. The thesis that educational programs should be f i t t e d as nearly as possible to the interests and capacity of the individual and in the light of the requirements of the vocation he expects to enter, it seems to me is incontestable. The proposal to hasten the consolidation of rural schools into units large enough to insure good facilities and staffs is not new, but it should be prosecuted vigorously. I am in accord also, and particularly, with the establishment in communities that can afford them of institutes in which students can prepare themselves

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Editorial and News

Place of Science in the Education of the Consumer

NATHAN A. NEAL
Chairman, NSTA Consumer Education Committee

FOR TWO years a Consumer Education Study has been developing under the auspices of the National Association of Secondary School Principals. As the broad outlines of the Study have taken shape, various subject matter councils have been invited to participate. Groups in the fields of social studies, home economics, business education, mathematics, and science are cooperating by preparing reports which indicate the contributions which each may make toward the objectives of consumer education. Eventually all of these reports, including materials from the science area, are to be combined into a comprehensive statement intended to give direction and increased purposefulness to consumer education in the secondary schools of the country.

The National Science Teachers Association Committee on Consumer Education was appointed by President Philip G. Johnson in September, 1944. During the ensuing months the Committee has prepared a first draft of a report which is planned to have the same title as this article. Competent teachers in the fields of general science, biology, physics, and chemistry have prepared basic materials for the report. After a first meeting and discussion, a recognized authority in the field of consumer education in science teaching was employed by the Committee to prepare a first draft of the report. Early in March, 1945 the Committee met again to consider recommendations and suggestions from numerous individuals who read and studied the first draft. A revised report is now in the process of preparation.

The science report, as well as the materials from other subject matter areas, will in general cover the following:

a. What is consumer education?
b. How does the definition of consumer education, accepted as basic to the report, relate to teaching in this field?
c. Acceptable methods and materials now in use by science teachers in the education of consumers (with illustrations).
d. Proposals for continuing and improving the use of science in the education of the consumer.

THE REPORT will place special emphasis on definite areas in the field of science teaching. The first of these is concerned with food. Notwithstanding the broad emphasis placed on matters of food and diet in biology and other courses, it is true that poor nutrition exists in all income groups. Whatever the numerous causes of the nutritional shortcomings may be, science education must continue to emphasize the study of foods needed for good nutrition. This consumer problem heads the list.

Consumer problems connected with housing are quite different from those dealing with foods. Housing conditions throughout our country as a whole leave much to be desired. With the possible exception of factors relating to general location, architectural style, and financing, nearly all other major features of good housing are a responsibility of science teachers. Housing is second only to food as a consumer problem of science teachers.

The purchase of clothing is said to take about one sixth of the average consumer's income. In the past science teachers have sometimes thought it important to perform laboratory tests to identify fabrics and even different grades of various fabrics. The emphasis in the report is rather in the direction of how science may help more people to know about the nature and degree of consumer clothing problems and methods of investigating solutions of such problems.

A FOURTH important area deals with the broad subject of health remedies and services. Problems treated here include self medication, use of cosmetics, intelligent purchase

This and That

NORMAN R. D. JONES

Vice President of the National Science Teachers Association

Dr. Paul E. Kambly, Iowa state director, reports the largest membership in several years.

Sr. Lebrón, President of the Puerto Science Teachers Association (an affiliate) recently sent in eleven more members, raising their total membership in N. S. T. A. to 52. The group in Puerto Rico is to be commended for its fine showing in the first year of affiliation.

Mrs. Maria A. Ruiz, Supervisor of Science, Department of Education, San Juan, has been designated as the consultant to N. S. T. A., representing the Puerto Rico Science Teachers Association.

Miss Mary M. Hawkes, Montana State Director, is already making plans for next year's membership campaign.

Mrs. Myrtie O'Steen Baker recently became area director from Atlanta and Fulton County, Georgia, and has sent in her first memberships. We hope you keep up the good work.

Mrs. Gladys Nesbit, who recently became our New Mexico State Director, is revitalizing our work in that area. Several new memberships have been received.

Mr. Stanley E. Williamson, State Director of Oregon, is "laying the groundwork" for reviving their science organizations.

Mr. T. A. Nelson, Mr. M. W. Pratt and Mr. Glenn Tilbury are working towards the formation of a strong state science organization in Illinois.

Mr. Louis Panush, of the Central High School, Detroit, Michigan and his staff are doing a fine piece of work in publishing the Metropolitan Detroit Science Review.

One Hundred Percent Schools

West Junior High School, Kansas City, Mo.

Guayama High School, Guayama, Puerto Rico.

Hanley Junior High School, University City, Mo.

Sustaining Memberships

It is indeed gratifying that many of our members have sent in "Sustaining Memberships" this year. Sustaining members are those who contribute $5.00 or more to assist in carrying on the work of the Association.

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of health services, information needed in selecting a physician, utilizing information available from various government agencies, and the conservation of human resources.

In addition to the above areas the report will treat pertinent aspects of the broad fields of conservation, recreation, and others in which consumer problems are important. Special emphasis is given to the matter of the intelligent appraisal and use of materials which are available from private testing and rating agencies. Such materials are available free of charge or at low cost and often represent a very high order of scientific achievement. Criteria are suggested for judging the value of various sources of consumer information. The whole problem of standardization is discussed and suggestions in keeping with the best scientific thinking in this field are noted in the report.

Various methods by which consumer materials may be presented in the classroom are indicated. While recognizing the value inherent in several different methods of presentation, the report will take a stand in favor of including consumer science as an important part of biology, physics, chemistry and other established courses in the secondary school. The investigations made by the Committee have led to the recommendation that consumer aspects of various important science principles and facts be emphasized at the time of teaching, rather than in a separate unit dealing only with consumer materials. Various approaches and illustrations are suggested within the framework of the recommended procedure. It is expected that a final draft of this report will be available early in the summer of 1945. This report will be distributed without charge to all NSTA members.

THIS AND THAT

Continued from Page 13

Changes of Address

If you are among those who secure a new school for next year, please report your new address immediately to your membership chairman, Norman R. D. Jones, 5073a Mardel, St. Louis 9, Mo.

Renewal of Memberships

Incidentally many of you may desire to renew your membership for the 1945-6 school year before school closes (i. e. before spending all your money this summer). Your early attention to this will greatly facilitate our work. Please indicate it for a 1945-6 membership and mail your remittance to the membership chairman.

New State Directors

Prof. John Read, R. I. College of Education, Providence 8, R. I.

Mrs. Myrtie O'Steen Baker, Joe Brown Junior H. S., Atlanta, Georgia.

Conservation Section

Section 5, Article 3 of the By-Laws states, "groups of members having a common interest in a special phase of science may form a '*Section*' with the approval of the Board of Directors".

The first "Section" formed was the "Garden Section" under the direction of Paul Young, of Cleveland, Ohio. This group was formerly a Department of the National Education Association but felt that more could be accomplished thru cooperation with science groups.

This war has emphasized more than ever the need of conservation in its various aspects. There is a very close relationship between science and conservation, consequently it seemed ideal to set-up a "Conservation Section". This work is being organized under the direction of the following committee.

Mr. F. Olin Capps, Mo. Conservation Commission, Jefferson City, Mo.

Dr. Ollie E. Fink, Ex. Sec'y Friends of the Land, Columbus, Ohio.

Dr. Charlotte Grant, Oak Park High School, Oak Park, Illinois.

Other "Sections" are in process of organization.

December—"Science Teachers"

It is with pleasure that continued growth in N. S. T. A. has been noted. The "estimate of needs" for the December issue of the Science Teacher was inadequate. Other publications were substituted for this after the supply was exhausted.

If you can spare a good copy of the December Science Teacher will you please send it to the membership chairman. Calls have come for this issue which can not be supplied. Thanks.

"Science Is Power"

If you have not read the article "Science is Power" in Industrial and Engineering Chemistry, Vol. 36 Page 1077, December, 1944, it will be worth your while to do so. Some very pertinent facts are pointed out in this which can very well be carried over into other fields.

The importance of science has been demonstrated in this war. We must do all in our power to give as much science training as possible to elementary and secondary students so that they will desire to continue scientific studies to take their place among those technically trained.

Summer Meeting Cancelled

Due to the limitation of conventions the National Education Associaiton will not hold its Representative Assembly meeting in Buffalo as originally planned. Consequently the National Science Teachers Association will not hold its summer meeting which meets in conjunction with it.

Certificate of Affiliation

Groups which have affiliated with the N. S. T. A. are being sent a "Certifcate of Affiliation". If your group has not yet received its "certificate" please call this to our attention.

Committee Appointments

Dr. Philip G. Johnson has announced the following 1944-5 committee appointments:

Nominations

Emil L. Massey, Ch.
W. D. Bracken.
Leo J. Fitzpatrick.
H. R. Jennings.
W. L. MacGowan.

Program

Morris Meister, Ch.

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Problems of the Postwar Period Which Relate to the Teaching of Science*

By MISS BERTHA E. SLYE

School Service Department, Westinghouse Electric and Manufacturing Company, Pittsburgh, Pennsylvania

BERTHA E. SLYE
School Service Department, Westinghouse Electric and Manufacturing Company

ONE OF THE most stimulating and satisfying experiences in our life is the observation of the regeneration of the members of a community following a crisis. Each man assumes his responsibility in the mobilization of his human and material resources. In a severe crisis he can martial the human and material resources of his neighbors. Whether it appears in the form of a poliomyelitis epidemic, a fire tragedy, a flood, a sanitation problem, a shortage of food, or even something as tragic and extensive as a total war, the need for action is equally important for all. As long as his physical comforts are threatened he must begin to think in terms of:

1. His available human and material resources.
2. His consumption of the available stock in hand.
3. Methods of conservation of those resources for future consumption.
4. The creation of new resources once the stock is gone.

Immediately his attitude changes from one of complacency and laissez faireism to one of concern and immediacy of action. He is aware that his survival and that of his family and country are dependent on his mental alertness in the solving of problems. The crisis then can be said to be the sole motivating force in compelling him to be scientific in his outlook.

THE FEVER of this motivation spreads. It creeps into the city council meetings, the club programs, and into the town hall forums. But tragic as it may seem, it seldom reaches the discussions of the classroom until it has begun to wane in strength—frequently long after much damage has been done. The extent and immediacy of the discussion is determined by the intensity of the crisis and the countless emergencies created by it. However, when the affairs of a world crisis become so acute that they take on the aspects of a global war, the prosecution of which involves all available man power, the emphasis given to the classroom discussion of the war causes and effects becomes a matter of government exigency. The subject that most nearly approaches the preparation of those who are to participate in the war is given first consideration. In like manner the research in those subjects that can produce tools and methods for the survival of the men who are in combat duty and for the destruction of the enemies is given emphasis over research in other fields. Thus, since the subject of science and technology most nearly meets the means of helping man to utilize his available resources for his survival, and since the science teacher and the research scientist can provide the method of attacking those problems of survival and destruction, we find both

*Address presented at the Pennsylvania Educational Association, Department of Science Instruction, Harrisburg, Pennsylvania.

becoming something more than "figure-heads" in our community.

REVOLUTIONARY advances in science and technology brought about by the present global conflict eclipsed man's previous achievements in the use of energy and material resources; so much so, that many of the men in the armed forces were caught unprepared. The responsibility for this predicament can be placed at the doorsteps of the industrial research scientists and of the science educators. Too much of a gap has existed between the kind of techniques used in the industrial laboratory and those used in the classroom laboratory. The gap was conditioned, no doubt, by a number of factors:

1. Teachers were un-informed of the techniques of research carried on in the industrial laboratory.
2. Many of the classroom laboratories lacked adequate equipment to meet the needs of students in effecting a tie-up between the basic scientific principles and modern applications to the solving of problems.
3. Too much of a gap has existed between the work carried on by all classes of secondary education, particularly those of the physical and social sciences.
4. Too many library shelves have lacked current information on the kind of applied research carried on in the industrial laboratories or in the higher institutions of learning.
5. Techniques of laboratory practice and a loaded curriculum have not permitted enough freedom for actual laboratory practice by the students.
6. Instructors have been handicapped with administrative problems; and the administrative heads often lacked an appreciation of the science teacher's problems.
7. Research scientists of the higher institutions of learning and of the industrial laboratories have been indifferent to the relationship of secondary school science instruction to the kind of research carried on in the industrial laboratories.

HOWEVER, I do not wish to dwell on all of those "sins of omission" which may have complicated the problems brought about by this war crisis, or any other crisis. Neither do I wish to thrust into your horizon any spectres which will limit your visions of the post-war problems. Rather, I should like to point out the opportunities for the enrichment of your science curriculum brought about by the advances in scientific and technological research. The subjects of these many research activities should receive greater emphasis in your classroom discussion and should be the core of many experiments. These advances in research will of necessity bring about a re-assessment of the science program at all levels of education. This re-assessment is a part of the educational regeneration process which must take place following any crisis if we are to build a sound reconstruction program of education. One of the best ways for a science teacher to plan a reconstruction program is to clarify his vision of the activities of industrial research and its subsequent effect on the consumer; also their effect on the kind of teaching he will do in the classroom laboratory.

Three questions of immediate interest to the consumer and to the teacher of tomorrow's consumer are:

1. What developments in the laboratories of industries have made greater power available for future consumption?
2. What new methods have resulted in a more effective and economic use of our resources?
3. What emphasis shall we give to these developments in our classroom discussion and laboratory techniques at the secondary level of science education?

THE DEVELOPMENT of our natural resources of power are staggering to our imagination, and the exigencies of the war have set every laboratory in the country on edge in the creation of more power. What this will mean to our post-war world cannot all be disclosed at present because of military secrecy. Nor will time permit me to discuss all of the developments I would be allowed to talk about. However, for purposes of analysis, I should like to present one source of potential energy which already has modified our present living habits, and which is destined to completely revolutionize our daily activities

and methods of research following the present conflict.

The spectacular strides made in the development of the electron tube points to a practical use of electricity. Let me list a few inventions made possible by the electron tube, which stand to greatly influence our daily living.

1. Lamps electronically harnessed to a beam of high frequency radio energy can be lit in a room by a diathermy set, such as your doctor might use in treating a cold in your chest.
2. Infrared or radiant heat lamps electronically harnessed can be used for comfort heating.
3. Ultraviolet radiations from mercury vapor lamps can transmute oxygen of the air into ozone, thereby, helping such products as storage eggs to stay fresh longer.
4. The air of the home and community can be cleaned by means of an electrostatic cleaner.
5. Electronics will aid in the breeding of plants and production of food. It will provide more comforts and conveniences for the farmer.
6. In the field of external medicine, a considerable part will be operated by electronic techniques and appliances. The new electronic stethoscope, the electrocardiograph, the brain potential instrument known as the electro-encephalograph, and the electron microscope mark the transition from crude diagnostic methods of medical treatment to highly scientific techniques, many of which incorporate electronic devices.

   Already the ultraviolet ray is used for sterilization of the air and for the destruction of bacteria.

CERTAINLY any developments in laboratory research which effect our immediate home environment and our physical bodies should be a subject of discussion within the classroom. Such experiments as can be performed showing the principle of the electron tube and its basic application to products used by the consumer, should be an essential part of any secondary science course. For we are educating the consumer of today as well as tomorrow and a literate consumer is a stronghold of our democratic and social-scientific society.

But electronics to be used by home consumers have been totally eclipsed by the uses of electronic power in the operation and control of our industries. For we find it in use for welding, brazing, plywood drying, induction heating, power converters and electrolytic processing.

ALREADY is has set the stage for a creation of new wonders in transportation and communication. With the use of an electronic radio system known as "Frequency Modulation" annoying static in radio is eliminated. In like manner, the use of electronics as a generating power of television opens up a new source of visual media. With it we shall be able to bring world events to our public meeting halls and to our reside, and what is even better, to our classrooms. It will not only afford an educational media, but it will increase the desire for a greater use of visual media, as a step-up of the learning process. In the synchronizing of sight and sound it will make the "distant-present" real. It is man's highest achievement in the perfection of the art of communication; and as a medium of communication it will be used more than ever to develop an appreciation of the world events and man's use of his resources. It can be used to bring the activities of industrial scientific research into the class laboratory.

But it, along with all the visual aids must be accorded a correct place in the curriculum and used judiciously by instructors who are trained. A television program like all other visual media cannot be expected to do the whole educational job. It is just one more channel to take its place along with the movie, slide film, and the radio as a means of enriching the curriculum.

SO I COULD go on and present an analysis of all new developments. But I must concern myself with another picture that presents itself on our horizon; the creation of new resources to take the place of those which are being depleted. It is not possible, of course,

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Science Experiences With Nutrient Solutions and Plant Hormones

HUBERT J. DAVIS
College of William & Mary

NOT LONG ago a biology class at the Matthew Whaley Demonstration School decided to conduct some experiments with plants by raising them in nutrient solutions and using plant hormones. The freedom which the pupils and teachers of this school had in planning their work, the abundance of fine equipment and materials they had to work with, and the eagerness of the able group of pupils which undertook the work, made the project look encouraging from the outset. However, there were many ominous factors. For instance, the greenhouse which was a part of the science department had a North exposure which did not provide sufficient light to raise plants successfully. The city water from which the solutions were to be made was so heavily laden with salts that it could not be used. Time and facilities for the class to construct the needed apparatus could not be fitted into the industrial arts program. Neither the teacher nor the students had ever had any experience in the use of nutrient solutions or hormones.

Growth of pepper plant in 76 days. Plant A is the control and plant B has been treated with vitamin B_1.

The quotation "Fools rush in where angels fear to tread", expresses the situation in this case very well. In spite of these and many other problems the work was undertaken and carried on for a whole semester with many exciting experiences for the class, plenty of hard work, and some educational growth.

AS A BEGINNING step the class outlined broad objectives for the project. These were broken down into problems, and then into specific activities. Needless to say, very few of the real problems which developed as the work progressed were anticipated. So many and so trying were they, that a less determined group would have given up in despair.

The class divided itself into two competing groups, A and B, each consisting of fourteen pupils. These groups were further subdivided into seven groups of two each. Each sub group from group A was paired with a corresponding sub group from group B. It was planned to evaluate the work of the main groups on the basis of grades on a subject matter test, the general results of the experiments, and the efficiency, accuracy, and facility with which the work was conducted. This evaluation would be made at the end of the semester. The group having the best rating would have the honor of demonstrating the work of both groups to the parents at an "Open House" which was planned annually. Those having the lower rating would set up and take down the exhibit. The rivalry and friendly competition between the groups was stimulating and wholesome.

WITH THE objectives agreed upon, problems stated, and groups arranged, the class began some real work. A thorough search was made for text materials in the school library, at home, and in the William & Mary library. These sources yielded a surprising amount of materials. Additional books and pamphlets

were purchased. The books which proved to be most helpful were: Ellis, C., Swaney, M. W., *Soilless Growth of Plants*, Reinhold Publishing Co., New York, 1938, and Gericke, W. F., *The Complete Guide to Soilless Gardening*, Prentice Hall, Inc., New York, 1940.

Seed beds were prepared and germination of seeds begun at once. The class immediately realized the need for an understanding of the nature of solutions, and practice in the use of the balance, graduated cylinders, and other measuring devices. By the time a brief study of these things was about completed the seeds had begun to sprout. This provided an opportunity to study the structure of the root hairs, the cells, and the conditions necessary for the germination of seeds.

BEFORE any solutions were made up to feed the plants, tests were made on the city water which conclusively demonstrated its unsuitability for making up solutions. This resulted in a decision to use distilled water, which led to a study of distillation and a subsequent effort to distill several gallons of water in the laboratory. The distillation of so much water under such conditions proved to be too expensive and time consuming. The group decided later to use rain water altogether.

A, control plant in nutrient solution; B, in fertile soil; C, in nutrient solution, poor lighting and poor aeration of roots.

Individual reading and group discussions soon made the group familiar with the possible problems, what soilless culture involved, etc. They were now ready to select the problems on which they would work. In the meantime necessary containers were assembled, solutions made up, and plants distributed.

Growth of tomato plants in 73 days. A, control plant in nutrinet solution; B, in fertile soil; C, in solution deficient in iron.

Three of the seven groups worked on a food deficiency problem. One group selected the problem of aeration of the roots. One selected the problem of disturbed pH ion concentration. One undertook to raise plants with insufficient light, and another group undertook to study the toxic conditions of plants produced by an excess of certain minor elements.

EACH PAIRED group used four kinds of plants in its experiments. A control plant of each kind was raised in good soil with the best possible growing conditions maintained. Another control plant was raised in nutrient solutions. The experimental plant was raised in nutrient solutions with controlled experimental conditions. On all of the controlled experiments the identical factors were the amount of light, kind of plant, kind of solution used, the method used, the container, watering, the hormones used, and the length of time. Each of the paired groups was given absolute freedom in the choice of the method used, the formulae, the types of containers, and each was permitted to use any hormone in whatever way it wished. Of course it was necessary for the opposing group to duplicate the identical factors of his opponent's work.

No regular classwork was scheduled. From the beginning it was understood that if as many as fifteen pupils considered any problem important enough for group discussion a formal class would be called. After the work started in earnest no problems other than those originating with the group could be discussed. With real problems to be solved in

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Why Physics*

By LAWRENCE NORRIS

Fifth Avenue High School — Pittsburgh, Pennsylvania

MY INTEREST in things mechanical began in earnest in 1914 when my father bought his first automobile. During the next eight years I had torn down all moving parts of that car and never failed to learn some thing of the "how" and "why" it ran. My father, watching me begin with wrench in hand, may have had many misgivings but he did not voice them, and the car never failed to run after such an operation.

I remember some problems that troubled me at that time. When I ran up a hill so fast, or so far, that I was completely exhausted, I could not pull a lever and, presto, find new force to proceed up the grade. The car could do it. Why? Physics answered that question. After trips to the ice plant, I wondered how ice could be made during hot summer days. Physics satisfied this query. In fact, it answered old questions and asked new ones while always insisting that when a result is observed an underlying cause must be searched out. That eternal "why" is always there.

WE SHALL try to avoid such arguments as whether it is more important that an educated person should know what Hamlet said than that he should know why a lead storage battery may freeze when discharged. Let us solve that by saying that a person might well know both. For, whether we like it or not, we live on a planet obeying certain fundamental laws which seem to apply to all bodies of matter when acted upon by forces, any where in our vast universe. One might withdraw from human contacts and choose to live a hermit's life on some remote island but the laws of nature are there to challenge the mind. If our world of nature has interest for us, then physics must be interesting in spite of any teacher or any book.

Physics treats of mechanics-forces and matter in motion, heat, electricity, sound, and light, with the application of these to any phase of our daily life. Applications—here is where principles seem most to touch the lives of students. A boy makes a boat or fills a toy balloon—here is Archimedes' principle. He pumps up a bicycle tire—Boyle's law in use. Push the brake of a car—Pascal's principle operates. You may step from an untied canoe toward the wharf and fall in the water or lurch forward in a stopping street car—Newton's laws will explain. As one boy put it, "Every time I turn around now I find myself noticing applications of the things physics tells about". These examples are from the home front. How much more are many of our boys at the battle fronts applying the same principles. In a recent letter a boy in the Navy wrote, "I am on a brand new boat. I can't tell you what kind of a boat or what kind of a job I have to do on it but it sure has everything to do with physics". One does not have to be an Einstein or a Kelvin to find interest in these principles.

WATER flows in the path of least resistance and I fear we must say that human beings tend to avoid exactness in thinking. Physics, because of its use of mathematics in measurement, emphasizes exactness. Ask a class a question and several hands are vigorously raised. Often a student starts an answer briskly, boggs down, shrugs his shoulders, and ends with, "It's something like that". "Something like that" is not good enough when an engineer is calculating the cable to support a bridge or the diameter of the piston in your car. Accuracy is worth striving for in speech, in movement, or in business. Surely physics contributes much to one who builds the concept of accurate work as something important in his life. Students also say, "I know it but I can't say it". To know, usually means sufficient understanding to tell others so they, if reasonably intelligent, will understand also. For many, to understand a term or subject merely means to have heard its name or to have a few vague ideas about it. True understanding must involve seeing a problem, a job, or a new concept through to conclusion.

I am not so conceited over physics as to believe it or any other science is going to con-

*Presented in the Pittsburgh Teachers Bulletin, December, 1944.

vert the human race to the universal use of the scientific method or way of thinking, but certainly social life could be somewhat improved if more people could learn to apply logical thinking to their own personal and economic problems instead of allowing emotions to take complete control. The study of physical principles, especially by experiments, should show that honest and fair reporting of any fact or data as observed is the only way man has of getting new information about his world and nature's laws. One may predict certain results or wish experiments to turn out differently—this matters not one whit. Fact is not changed by our wishing or rationalizing.

MANY times I have watched groups of boys loafing and just talking. In such a group there is usually one who thinks he knows most of the answers, and if any one else crossses his opinion, he comes back with, "I'll bet you a dollar that's true". Science study should show that betting a dollar has little to do with establishing truth.

It has been said that we see what we know. One person looks at an electric lamp and sees only a small glass bulb costing a few cents. Another person, more observing and with training, sees a glass bulb, roughened, then smoothed on the inside with acid. He sees wire alloys whose rate of thermal expansion is equal to that of the glass, carrying current into the lamp. If the wire expanded faster than the glass, or vice versa, air would be admitted and the lamp quickly ruined. Next in interest is the filament made of a fine coil of tungsten—that wire which has the highest melting point of any metal. Around this filament is an inert gas, argon or nitrogen, thus allowing this lamp to burn many degrees hotter and with greater efficiency than lamps made twenty years ago. These details have interest for the physics trained person because he knows of the months, years, and even lifetimes of work which have gone into development of these apparently simple devices which serve us well.

A PHYSICS teacher must always get a quiet thrill from the "light up" in the faces of students when discussions about motion are in progress. When a fly is moving leisurely back and forth in a closed automobile moving along the highway at 50 miles per hour, why doesn't the back of the car come up and strike the fly? If a man jumps up in the aisle of a speeding train, will he come down behind or at the spot from which he jumped? Boys often ask, "Why can't an aviator take off from our airport and circle overhead for three hours and upon descending find himself in San Francisco instead of Pittsburgh?" I enjoy having students show evidence of thinking about the observations they have made. When explanations of these problems are thought through carefully with a class it is interesting to see faces light up here and there.

THOUGH some persons taking physics may never make a dollar from their knowledge, physics has considerable cultural value. In the study of mechanics we learn that in all simple machines, when there is a gain in distance or speed, there is a compensating loss in force; or as force is gained, speed and distance must be sacrificed. Does this law apply only to machines? Let us see. Winning wars brings added responsibilities to make the peace workable. Movie star popularity brings autograph seeking crowds. Power brings distrust and hatred along with public applause. A well taken, unannounced guidance lesson may stem from this idea.

It is a quieting thought and one which can have considerable steadying effect on one's philosophy of life to know that, no matter how much man upsets his society, misuses his resources and physical knowledge, two plus two make four and nature's laws continue to operate unfailingly century after century.

It becomes a most miserable existence to dislike the thing you must do or to do the thing you dislike. Much better is it to like the thing you must do or to do the thing you like. There is a shade of meaning here which may spell a well-ordered life or a disgruntled one. I like physics for it promotes patience, accuracy, honest respect for experimental fact, calm assurance in nature's orderly behavior, and interest in our world. Besides challenging one's mind it gives ample possibilities to develop skills in constructive work with the hands. That of itself brings satisfaction.

Long live physics.

A Combination Camera and Dark-Room

HERMAN BERLIN

Franklin K. Lane High School — Brooklyn, New York

THE PROPER presentation of the processes of photograph is usually neglected by science teachers because of unfavorable conditions. The regular classroom cannot be darkened sufficiently for the safe handling of films or plates. A dark-room large enough to accommodate a class is rare in our schools. Even a simple topic like *"The Parts of a Camera"* is seldom taught so that each pupil sees each part clearly and understands its function. Usually a box camera is taken apart and the small black parts are pointed to and discussed by the teacher. The defects of this method are apparent even if the parts themselves are not.

The equipment to be demonstrated here was designed as a teaching aid. Its use during the past five years in general science classes at the Franklin K. Lane High School has proved its practical value.

THE DIMENSIONS given on the diagrams need not be followed exactly. The distance between the lens and ground glass back may be found by holding the lens about three feet from an illuminated object and focusing the image on a sheet of ground glass.

The plates used are Eastman Kodak Process Plates. The exposure with a No. 1 Photoflood bulb in a reflector held about three feet from the subject's face should be about two seconds. The developing solution used is the one recommended—"D-11." Its formula may be obtained from the Eastman Kodak Company and is packed with the plates. Five minutes are usually required, but the time may be shortened by using a No. 2 bulb or increasing the exposure. The regular Eastman Kodak fixing solution, made by dissolving the prepared powders, is used for four minutes. It is advisable to rinse the negative in a basin under running *cold* water for about five minutes and then place it on edge for drying. It is best to use a second period for printing the positive. The same solutions may be used.

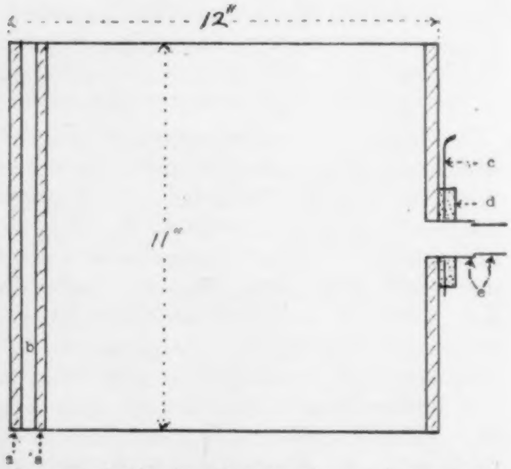
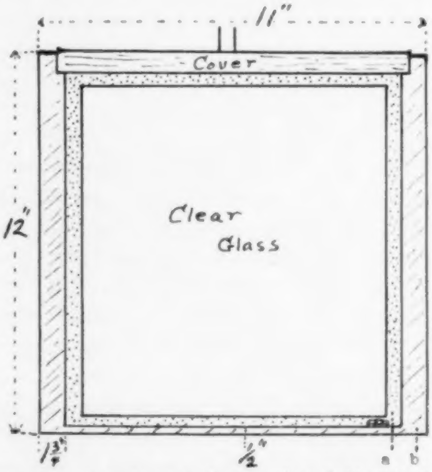
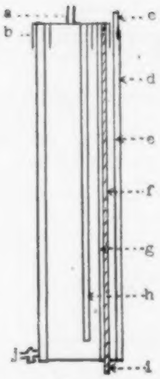


Diagram of side view of camera box. a is a quarter round; b, groove to hold tank or ground glass; c, sliding plate diaphragm; d, wood block; e, sliding metal tubes.



Front view of tank. a is U channel to hold slide, b is brass strip to slide in groove of camera box.

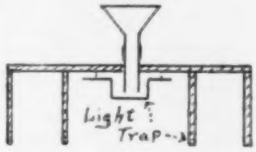
THE TANK is a plate-holder as well. It is loaded in a closet or dark-room, in advance. After the image is focussed sharply on the ground glass, the latter is lifted up out of the camera and the plate-holder put down in its place. The metal slide is lifted nearly out of its groove on the front of the holder-tank. The shutter of the camera is opened at the same time, thus allowing the image to pass through the clear glass window and fall upon the plate. The shutter is then closed and the



Side view of tank. a is inlet tube; b, light trap; c and e, metal slide; d, U channel for slide; f and i, brass strip; g, clear glass; h, plate holder; j, drain.

slide pushed down. The developing solution is then poured down the funnel into the tank. After the proper time the drain cock at the bottom of the tank is opened and the solution allowed to run into a bottle for future use. The drain cock is then closed and the fixing solution poured into the tank. After the plate has cleared so that the unaffected parts of the emulsion are dissolved away, the fixing solution is drained off into another bottle. The cover of the tank is removed and the plate lifted out. It is rinsed under running water and set up to dry. The lights may be on during the entire processes of developing, fixing, and rinsing, as light cannot enter the tank.

In constructing the camera, the length of the box will be determined by the focal length of the lens, and the size of the ground glass by the space the lens covers effectively. Focusing is accomplished by sliding the metal tube in or out that holds the lens. Light is admitted through a circular opening in the sliding plate diaphragm. This is best made of metal. The size of the opening in it will depend on the size of the lens. The front of the camera box can be hinged to one side so that it can be opened for inspection by students.



Tank cover, showing light trap.

The tank that holds the film or plate at the back of the camera has a clear glass window on the front side to allow light to fall on the film. A metal slide covers the window except at the time of taking the picture. The tank is so constructed that the plate holder inside it comes into the exact position of the ground glass when that has been removed and the tank slid into position. The brass strip on the side fits into the groove which holds the ground glass. At the top the light trap allows a solution to flow into the tank but excludes light.

All metal parts are brass, soldered together, painted with black Kodocoat. Glass is bound to metal with asphaltum. A strip of velvet is cemented across the upper edge of the clear glass window on the outside to prevent light from leaking past behind the metal slide.

WRITE FOR IT

Biology teachers may obtain the following items free from the Spencer Lens Company, Buffalo, New York. Write for them on your school letter head.

Photographic Diagram of a Microscope. All working parts are shown in cross section and properly labeled. On $8\frac{1}{2}$x11 sheet punched for notebook. These may be obtained in limited quantity for students.

Method of Calibrating Micrometer Discs for Eyepieces. An $8\frac{1}{2}$x11 sheet with photograph of microscope, punched for notebook. Describes calibration method. Traces path of light through a microscope.

The Effective Use and Proper Care of the Microscope. A 62 page booklet with cover. Covers elementary methods, preparation of materials, as well as advanced technic. Useful for student and teacher.

The Use of Polarizing Microscopes. A 20 page booklet describing characteristics and use.

I Saw Them Making Microscopes. A 20 page descriptive booklet, illustrated.

Blackboard Lessons on Food. A 40 page booklet and cover. Discusses kinds of foods and good sources. Wheat Flour Institute, 309 West Jackson Blvd., Chicago.

Science for Society

EDITED BY JOSEPH SINGERMAN

• A department in which science is presented in its close relationship to the individual and in which guidance is given in causing the individual to recognize the methods of science and its vast social implications.

Dr. Montagu has for many years been a prominent and courageous figure among those men of science who gave expression to the need for actively combatting fallacious racial doctrines. He was among those who at an early date recognized their danger in the role of a sort of cancer by which Fascism was boring within the society of the democratic nations of the world. Racists often attempted, with eugenic theories, to endow their doctrines with an air of respectability. Montagu shared the view of most geneticists in holding that eugenics, the doctrine of improving the human race by selective breeding, finds no support in science. Today, while we prepare the military defeat of Fascism, it is timely to divest ourselves of its racist doctrines implanted within our own society.

The editor of this department subscribes to Dr. Montagu's deductions because that seems to be the only proper attitude to take on the basis of the scientifically observed facts. For a more thoro treatment and expression of this point of view, the reader is referred to the forthcoming book, by the same author, *Man's Most Dangerous Myth: The Fallacy of Race.* (Columbia University Press).

J. S.

Eugenics, Genetics and Race

M. F. ASHLEY MONTAGU

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HUMAN beings are complex structures, and it is never an easy thing to analyze the motives involved in their behavior. The fact is that the individual himself is rarely able to give a satisfactory account of the motives for his behavior, since the elements entering into it may be diverse and complex. One should therefore be wary in attempting to interpret the behavior of others. Eugenists believe that the human race is threatened with decay, and that if the race is to be made safe for the future, steps must be taken to eliminate the undesirable decay-producing elements and to produce a general improvement in man's physical and mental structure by selective breeding. Eugenics means good breeding. In my experience eugenists are sincere individuals who are honestly anxious to be of service to their fellows, not to mention future generations. But their doctrine is fraught with danger. In this country and in others eugenics has been converted into a movement in the service of class interests. This is so well exemplified by the writings of the late Madison Grant and Henry Fairfield Osborn, not to mention numerous others. In Germany we have all witnessed the tragic effects of the teaching of mythological race doctrines and of the practice of "Race Hygiene." Such activities have caused eugenics to fall into disrepute among scientific students of genetics, the science of heredity, upon which eugenics claims to be based. The clear stream of science must not be polluted by the murky visions of politicians on the effete potions of castes with a hypertrophied sense of their own importance.

IT IS A praiseworthy thing to look forward to, and to work for, a more humane humanity, a world with fewer imbeciles, degenerates, criminals, one inhabited by greater numbers of highly intelligent individuals. But it is quite certain that such a state could never be achieved by such practices as the eugenists recommend. Inherited disorders such as certain types of feeblemindedness call for sterilization. Common humanity demands that. But one is deceived if one believes that by such measures feeblemindedness would be appreciably reduced. From this moment on were every feebleminded individual to be sterilized for the next two thousand years, the reduction of feebleminded individuals in the population at the end of that time would be not more than 50 per cent. It is a very long time to have to wait for such a return. Superior and more immediate remedies are available.

One Human Race

THE EUGENISTS, in offering their dubious cures for our alleged biological ills, go even further, and pretend to perceive biological

differences between "Races" which they arbitrarily designate as "superior" when it is the "race" or stock to which they happen to belong, and as "inferior" all or most of the others. The corollary to this is that racial miscegenation should be prevented if racial degeneration is not to ensue. It is with this aspect of eugenics that we shall be concerned here.

The term, "race," as applied to groups of human beings, is an unscientific one. It was not proposed or invented by scientists, but has been thrust upon them by popular usage. Science knows of nothing in the real world relating to human beings which corresponds to what this term is usually assumed to mean, that is, a group of individuals marked off from all others by a distinctive heredity and the possession of particular physical and mental characters. In the sense just defined there is only one race, or one thing which corresponds to it, and that is the human race, embracing every human being. It is, of course, clear that there exist certain groups of the human race which are characterized by differences in pigmentation, hair form, and nose form. These may be regarded as varieties. If, as seems clear, all human groups are derived from a common ancestry, then it is further clear that such differences represent either the expression of mutant genes or else the action of natural selection probably abetted by social selection. In any event, such varieties would by their very existence prove that according to the values with which we have endowed nature, they are biologically perfectly fit. There can therefore be no argument on the score of the physical or biological structure of any variety—unless an appeal be made to purely arbitrary and irrelevant aesthetic standards. Actually, the argument is always based on the existence of alleged mental and cultural differences. These are invariably assumed to be biologically determined. For such an assumption there is not a scrap of evidence. On the contrary, the substantial body of evidence now available proves that when the members of any variety of mankind are given adequate opportunities they do quite as well as those of any other variety who have long enjoyed the advantages of such opportunities.

MENTAL ability and cultural achievement are not functions which are in any way associated with genes which are linked either with those for skin color, hair form, or nose shape. It is, therefore, from the genetic standpoint, impossible to say anything about an individual's mental ability or cultural achievement on the basis of such physical characters alone. Cultural differences between peoples are due to a multiplicity of historical causes, which have nothing whatever to do with genes, which are essentially of a social nature. To the same causes are due the mental differences between members of those different cultures. Hence on biological grounds, and as a consequence of the common ancestry of all peoples, however much they differ from one another in their physical characters, there is every reason to believe that innate mental capacity is more or less equally distributed in all its phases in all human groups. If this is so, and this is a matter which can be tested, there can not be the slightest justification for the assertion that racial miscegenation would lead to the intellectual deterioration of any people. The evidence is all to the contrary, as proven by the phenomenon of the hybrid vigor both among human beings and among the majority of other living things.

Human Race Improving

NOW, WHEN eugenists assert that there has been a great increase in degeneracy, criminality and feeblemindedness, and that the "race" is deteriorating, it is usually taken for granted that they know whereof they speak. But, the truth is that except for the bare statement, hardly any evidence is ever forthcoming to support their jeremiads. Today, our great variety of recording facilities as compared with those in existence a hundred years ago are immeasurably superior, and our hospitals, physicians, asylums, police, and incentives to crime vastly more numerous. Yet, with all these tokens of modern declension, the expectation of life of the average individual has practically doubled. Some of the worst scourges of mankind, such as the vitamin deficiency diseases, typhoid, typhus, yellow fever, diphtheria, tuberculosis, and so on, have been almost wiped out. During this period there has been such a burgeoning of inven-

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Education for Conservation

CHARLOTTE L. GRANT

Oak Park High School Oak Park, Illinois

A SERIES of three pamphlets on biological subjects were prepared by the author of this paper while working with the Bureau of Educational Research in Science, Teachers College, Columbia University, in 1941-1942, under the direction of Dr. S. Ralph Powers. The first of these, *Plant and Animal Communities,* was used in eight high schools and one elementary school. The various techniques used in teaching this pamphlet have already been reported.

The second pamphlet, *Forests and Man,* described the changes in American forests over a period of years, discussed the relation of forests to human welfare, and emphasized the conservation of our forests. Embodied in this concept of conservation is a knowledge of plant succession, reforestation, forest management and economic security. Suggested projects and lists of books closely allied to the pamphlet content were used throughout. Maps and tables accompanied the chapters. Report blanks to secure student opinions of pamphlet concepts as applied to their own communities were sent to each class using the pamphlet. Two hundred and ninety high school students in Middle West and eastern cities studied the pamphlet.

MOTIVATING devices and pencil-and-paper instruments found useful by teachers in the teaching of *Forests and Man* are presented in outline form with brief discussion.

Pre- and post-tests on

1. Pamphlet information
2. Skill in interpretation of tables and maps; in identification of visual materials such as slides, pictures, leaves and bark; in recognizing trees; and in performing experiments.
3. Attitudes about forest conservation and conservation of forest wild life.
4. Interest and participation in forest activities.
5. Interest and participation in travel to national and state parks, forests and monuments.

These tests proved useful in evaluating the kind and amount of information, skills, attitudes, and interests possessed by young people as well as the changes which might occur as the result of studying the pamphlet.

It is interesting to note that on the Forest Activities inventory the activities checked as "liked best" were *camping, hiking,* and *picnicking.* These varied only in arrangement from the pre- to the post-test in both cities. As for "would like to try" activities, *building a cabin in the woods* secured first place in both cities; *fighting a forest fire* and *rolling logs into river* placed second in the Midwest city while *hunting game birds and other animals* was given as second choice by students in the eastern city.

ON THE TRAVEL inventory Middle West students indicated that they had traveled more widely in the Central and Lake States than in other sections of the country; and the eastern students had traveled more extensively through the Middle Atlantic States. Except for Yellowstone and Smoky Mountain National Parks, few national parks or forests had been visited. However, many state parks had been seen and a number of state forests had been explored.

Class and committee projects, such as

Relief map of United States made of papier-mâché, to show forested and non-forested areas together with cities containing forest industries.

Map showing forest soils and agricultural uses.

Identification of trees in vicinity.

Collection of leaves, fruits, twigs and bark.

Collection of insects, particularly forest tree pests.

Study of woods and their uses.

Writing for and reports on literature from Forest Products Laboratory, Madison, Wisconsin.

Listing and exhibit of articles of metal for which wood may be substituted.

Visits to lumber companies.

Mapping routes for local supplies of lumber.

Wood distillation experiments.

Planting trees on school grounds.

Making scrapbooks of pictures and photographs of wild animals, wild flowers, fire, disease, and floods.

Reports on lumbering, sawmill activity, and wood-using industries in community and state.

Visit to wood-working classes in school.

Construction of birdhouse and feeding station.

Securing literature on bird-banding from U. S. Bureau of Biological Survey and learning to band birds.

Making a nature trail.

Report on hunting and fishing laws of state.

Making slides and photographs of wild life, parks, and forests.

Collecting postage stamps picturing national parks, forests, and monuments.

Survey of forest preserves and parks in community; trips to these and reports on areas.

Visits to School Nature Preserve and report of its uses in teaching conservation.

Survey of books and magazines dealing with forests; reports and exhibits of these.

Visit to State Conservation Department to secure pamphlets and films on state projects.

Maps to show national and state parks, forests, and monuments.

Reports on national and state parks visited.

Visit to a farmer's woodlot to determine how it was being used.

Selecting a class committee to visit city or county planning board to learn its program with respect to parks and forests.

Study of sustained-yield forest management in near-by state forest.

Survey of organizations active in conservation in community and school.

Hobbies stimulated by project activities

Outdoor activity, such as hiking and camping.

Planting trees.

Photography.

Joining organizations participating in conservation.

Collecting stamps, woods, leaves, fruits, and insects.

Reading books and magazines on conservation and forestry.

Reading newspaper each day to discover new legislation on national forest areas or new state conservation projects.

Building birdhouses and feeding stations.

Bird banding.

Identifying trees, wildflowers, and birds.

Making a wildflower garden.

Student essays and discussions in class

Causes of change in our forests, 1640-1942.

How America can prevent deforestation.

Forests—a home for wildlife.

Forests and climate.

Our forests, a renewable resource.

The relation of forests to soil erosion.

The future of our forests.

The wealth of the woods.

Forests and fortunes.

The lumber industry in America.

Man's relation to the forest.

Agencies active in forest conservation.

Our community forest.

How to restore balance to a forest where deer are over-abundant.

What to do after a forest fire.

Forestry as a career.

"Forest Defense is National Defense."

Student discussions outside of class with

friends, parents, teachers, campfire and boy scout groups on:

- forest products
- forest fires
- forest diseases
- reforestation
- sustained-yield management
- floods
- national parks
- wildlife protection
- forest defense

Anecdotal records by teachers or committees of students to show individual acts of conservation, class cooperation in conservation and cooperation of class members with community agencies of conservation.

Diaries of daily happenings in class while studying *Forests and Man* by class secretary.

Continued on Page 44

Science Clubs at Work

Edited by DR. ANNA A. SCHNIEB
State Teachers College Richmond, Kentucky

• A department devoted to the recognition of the splendid work being done by the science club members and their sponsors in the various State Junior Academies of Science. Material for this department, such as student made projects; demonstrations and posters; outstanding club programs; state and regional meeting announcements; should be sent to Dr. Schnieb.

The Virginia Junior Academy of Science Moves Forward

THE COUNCIL of the Virginia Academy of Science at a recent meeting adopted two major projects for the Academy for the coming year. They were (1) the promotion of science club activities, and (2) the organization of a science talent search for Virginia.

Mr. Hubert J. Davis, of the College of William & Mary was re-appointed as chairman of the science club committee. The council challenged this committee to organize a science club in every high school and affiliate it with the Virginia Junior Academy of Science. It also requested that the committee sponsor a meeting of the officers and delegates of the Virginia Junior Academy of Science at the same time and place as the meeting of the Virginia Academy of Science, and that it explore the possibilities of regional and state science fairs in the near future.

Dr. Thomas D. Rowe of the Medical College of Virginia was selected as chairman of the Science Talent Search Committee. This committee was requested to work out the administrative details of a science talent search for the science clubs, find at least $5,000.00 to be spent annually for scholarships for the outstanding science pupils, and devise tests by which the recipients would be selected.

In 1943 the Research Committee of the Virginia Academy of Science voted to give $50.00 as a prize to the science club which did the most meritorious work. At this meeting of the Academy Council this prize was established permanantly as the *Miller Award* in honor of Dr. E. C. L. Miller, Secretary of the Virginia Academy of Science, who has provided leadership since the organization of the academy almost a quarter of a century ago.

The Miller Award was earned by the Warren County High School Science Club of Front Royal, Virginia. It was presented by Dr. Dabney S. Lancaster, Superintendent of Public Instruction of Virginia, to Robert Kesler, president of the club, at ceremonies held in the high school auditorium on November 17th.

Dr. Lancaster was introduced to the school by Division Superintendent, G. Tyler Miller. In his address to the club, Dr. Lancaster emphasized the importance of training for leadership, of vocational exploration through science club work, and the need for research and study of the Virginia natural resources.

THE CLUB was fortunate to have on its program Dr. E. C. L. Miller in whose honor this award was established, and Dr. Thomas D. Rowe, chairman of the Science Talent Search Committee of the Virginia Academy of Science. Dr. Miller, in his address spoke of the efforts to utilize the member clubs of the Junior Academy of Science in cooperative projects with the weather bureau, and other organizations in such manner as to make their work useful as well as educational. Dr. Rowe spoke of the organization of a talent search in Virginia through which outstanding science pupils will be given an opportunity to compete for scholarships amounting to $500.00 or more.

The Warren High School Science Club is sponsored by Miss Vada C. Miller. It has the distinction of being the first club to receive the *Miller Award*. It was selected this year in competition with eighty-five science clubs on the basis of its contribution to the Virginia

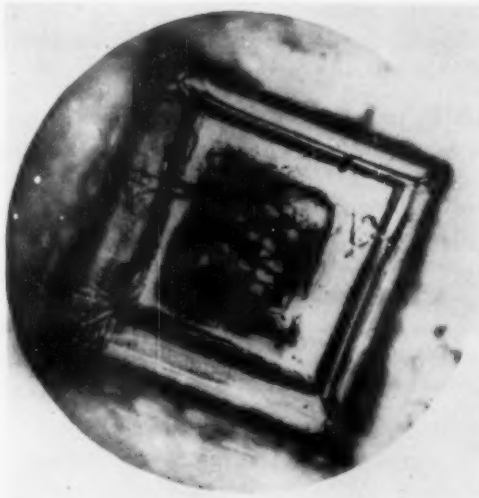
Junior Academy of Science, its community, school, and individual members. This club has taken an active part in the affairs of the Virginia Junior Academy of Science and last year furnished it with a president, Louis C. Grannis, Jr., and a secretary, Mr. Byron Stokes. This club led its school in the celebration of American Education Week; organized the audio-visual program, and provided the trained personnel for conducting it; provided a science exhibit for the school; conducted a panel discussion for the student body; and carried on club projects concerning penicillin, sulfa drugs, chemical warfare, plastics, electronics, synthetic rubber, and others.

In keeping with the high standards of unselfish service, the president of the club announced that the award money would be spent to provide film strips and slides for the school.

Crystals in High School Chemistry

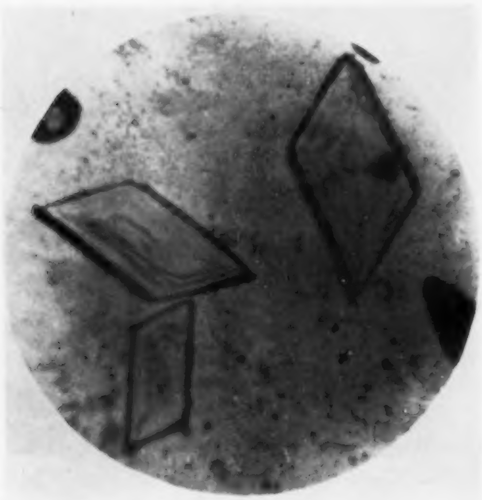
KARLEM RIESS
Tulane University

MODERN textbooks of high school chemistry do not devote many pages to a study of crystals. They mention general methods of crystallization and fractional crystallization. References to internal structure are usually confined to a diagram of the sodium chloride structure and a paragraph or two on X-ray methods. There is no material for those students interested in the simpler experimental techniques of crystallography. To overcome this some interesting experimental sequences have been arranged for high school students.



Sodium chloride crystal

As an introduction to the study the students were given the usual text material about solids, then an outline of the six systems of crystallization. Pasteboard or plaster models of crystals illustrating the six systems are very helpful. Internal structure was discussed non-mathematically, including the elementary X-ray methods. The concept of cell shape and size was emphasized.



Photomicrograph of copper sulfate crystals.

The experiments designed to supplement the theoretical discussions may be grouped into two sections: (a) slow crystallizations, with results observed by a hand lens or low power microscope; (b) more rapid crystallizations, with results observed using a low or high power microscope. Those in the first group are the usual "standard" experiments of any general chemistry course. Those in the second are reactions which are often used

Ammonium picrate crystals

as identifying tests for the particular chemical elements involved.

SOME students amplified the original experiments by taking photo-micrographs of some of the crystals. No elaborate apparatus was used. The camera was a miniature Speed Graphic, film size 2¼ x 3¼ inches. The microscope was one of the student forms found in high school biology laboratories, with 4 and 16 mm objectives and a 10X ocular. Most satisfactory conditions for photographing were obtained by trial and error.

Summary of Experiments

Type A—Slow Crystallizations.

In these experiments crystals were obtained from saturated solutions, without artificial drying. All crystallizations were made on microscope slides.

(1) Potassium alum—$KAl(SO_4)_2 \cdot 12H_2O$—colorless cubic crystals.

(2) Sodium chloride — $NaCl$ — colorless cubic crystals.

(3) Cupric sulfate — $CuSO_4 \cdot 5H_2O$ — blue triclinic crystals.

(4) Magnesium sulfate — $MgSO_4 \cdot 7H_2O$—colorless, orthorhombic needles.

(5) Sulfur—S—yellow, rhombic crystals.

Type B—More Rapid Crystallizations.

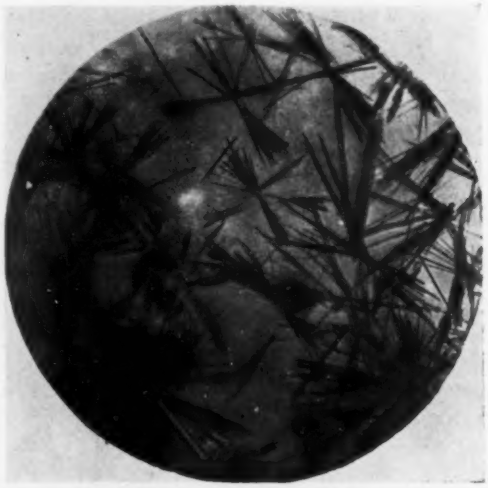
These reactions were made on slides, with drying over an alcohol lamp. They were made according to the techniques of chemical microscopy. These include solid-liquid and liquid-liquid reactions, with drying after reaction or partial drying before completion of the reaction. Students were permitted to use any method and were encouraged to try several. Types and colors of the desired results were given before the experiments were begun.

(1) Potassium picrate — $C_6H_2(NO_2)_3OK$—from potassium chloride and picric acid, in alcoholic solution. Yellow, needle-like crystals, or long yellow prisms.

(2) Sodium picrate — $C_6H_2(NO_2)_3ONa$—from sodium chloride and picric acid, in alcoholic solution. Short, yellow needle clusters.

(3) Ammonium picrate — $C_6H_2(NO_2)_3ONH_4$—from ammonium chloride and picric acid, in alcoholic solution. Long, yellow needles.

(4) Mercuric iodide—HgI_2—from mercuric chloride and potassium iodide. Vermilion red, small tablets and rosette-like aggregates.



Photomicrograph of calcium sulfate crystals

(5) Potassium perchlorate — $KClO_4$—from potassium chloride and perchloric acid. Colorless, orthorhombic crystals.

(6) Sodium perchlorate — $NaClO_4$ — from sodium chloride and perchloric acid. Colorless, rhombic crystals.

Continued on Page 44

The Simplification of Chemical Reactions Between Steam and Certain Elements

NATHAN FEIFER

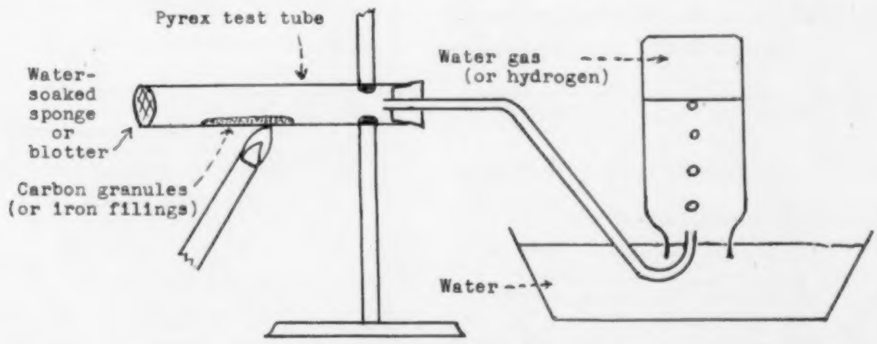
The High School of Science — Bronx, New York

SEVERAL demonstrations in the high school chemistry course have become unpopular because of the relative complexity of the apparatus devised for their performance. One of these experiments is the preparation of water gas by the interaction of carbon and steam. In the most widely used demonstration of this process an electric arc is struck between two carbon rods, thus heating them to incandescence. Live steam, which is generated in an adjoining vessel, is passed over the glowing carbon. This results in the formation of a mixture of hydrogen and carbon monoxide. The water gas obtained in this manner is then collected by the displacement of water. Although this technique yields excellent results, the required equipment is rather elaborate and is unobtainable, therefore, in many high schools.

An alternate method for the preparation of water gas is suggested here. In the accompanying diagram the water soaked sponge (or blotting paper) serves as a source of steam. First, the region under the carbon is warmed for about one minute and then it is heated strongly until the carbon glows noticeably. This is followed by the heating of the region under the sponge for the barest fraction of a second and the burner is returned to its position under the carbon. The carbon is heated strongly for another ten full seconds. The evolution of water gas will now occur. The alternating process of heating the blotter for a fraction of a second and heating the carbon for ten seconds is continued until the desired volume of water gas has been obtained. It is essential, however, to keep the carbon glowing until the reaction is complete.

THIS technique may also be used to supplant the usual methods employed to demonstrate the formation of hydrogen by the reaction between iron and steam. The same arrangement of apparatus is used. A water soaked sponge will supply the necessary steam. The region formerly occupied by carbon in the water gas experiment is now covered with iron filings. The procedure followed is identical with that described for the making of water gas.

Each of these experiments yield satisfactory results. Each is a simplification of a standard high school demonstration.



Apparatus for making watergas

WRITE FOR IT

Through Silken Sieve. A 40 page booklet. Tells about the making of flour. Wheat Flour Institute, Chicago, Ill.

Your Child's Teeth. A 40 page booklet with cover, lavishly illustrated. Bureau of Public Relations, American Dental Association, 222 East Superior St., Chicago 11, Illinois.

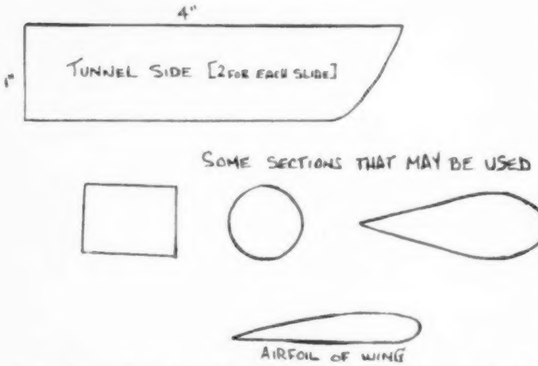
A Simple Wind Tunnel

JACOB BRODKIN

Jr. High School 6 **Brooklyn, N. Y.**

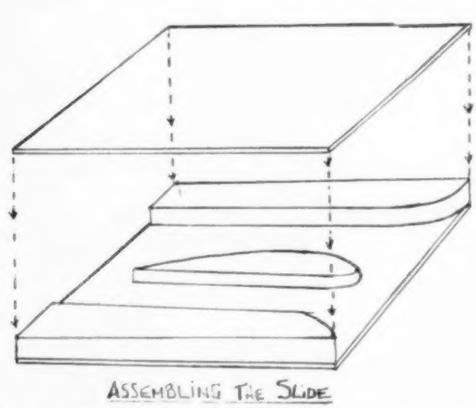
THIS WIND tunnel is meant to be a substitute for the more elaborate equipment used in the higher grades. With it one can show the effect of streamlining and the flow of air over a cambered wing section.

To construct the tunnel, cut from any quarter inch board (balsa will do) two of the forms labelled "tunnel sides" in the construction diagram. For each section two of these will be needed. These serve to confine the smoke flowing over the test section. The forms to be tested are cut from the same board in the sizes shown in the diagrams.



Some shapes of sections that can be used for showing air flow

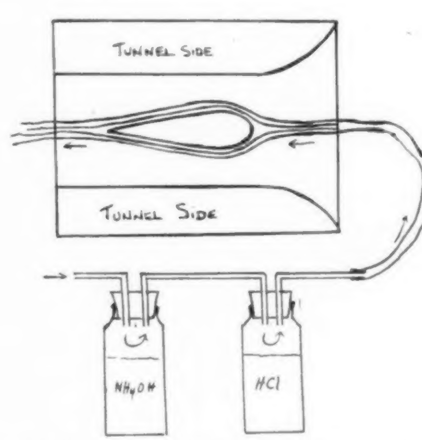
TO ASSEMBLE the slide, glue the two tunnel sides to a lantern slide and glue the section to be tested between the two sides. Another lantern slide cover is placed over the assembly and the entire assembly is bound together with tape.



After placing sections in the desired position for a test, lower the upper section in place.

To demonstrate, blow smoke from a generator, as shown, or from a cigarette into the slide. By holding the slide in the beam of a lantern slide projector a very satisfactory shadow will be thrown. Results will also be visible if the demonstration is done in front of the classroom window. Do not allow too much smoke to be blown through. Better results are obtained at lower air velocities with thinner smoke.

BY MAKING a set without the tunnel sides and using a wing cross section, the effect of increasing the angle of attack of a wing can be shown. As the slide is tilted to increase the angle of attack the air stream will suddenly bubble when the wing is at the stalling angle.



A dense white smoke to show air flow can be made from ammonia and hydrogen chloride gases.

Have you any simple demonstrations that require only simple equipment? Other teachers would like to know about them. Send them to us for publication.

SCIENCE EXPERIENCES

Continued from Page 19

order to accomplish the tasks the pupils had outlined for themselves, they requested more class discussions than time would permit.

The work progressed smoothly, and no one seemed to ever find time to loaf or disturb others. The pupils gathered a lot of data, and came to many tentative conclusions. However, this data and their conclusions were of little real scientific value since their work consisted largely of duplicating the work of professional scientists. Yet each group had their own individual approach and they learned science the way real scientists do. Figure 1 shows the results of some of their experiments.

IN CONDUCTING their experiments they had to learn the use of the balance, metric system, hydrometer, thermometer, photometer, and the microscope. Each of the handicaps with which they started proved to be helpful in the long run. They tried many ingenious devices for supplementing the light for the plants, and some of them were successful. They learned an excellent lesson about the use of distilled water. The construction of the needed equipment as a part of the science work gave them many creative activities and finally resulted in the establishment of a small shop in connection with the science department. The many guide sheets, adaptations of formulae, learning outcomes, directions for constructing equipment, etc., resulted in a monograph on "*Suggestions for the use of Nutrient Solutions and Plant Hormones to Teach Science*".*

The pupils also found it necessary to learn many biological principles such as the structure and function of the stems, leaves, and roots, the process of transpiration, photosynthesis, respiration, circulation, osmosis, and capillarity. While some of these activities were anticipated in setting up the objectives, the pupils could have never foreseen many things they had to learn the hard way, such as: (1) the importance of keeping consistent and accurate records of the experimental work, (2) that plants don't "just grow", but require much attention and care, (3) that raising plants in nutrient solutions presents many interesting problems, (4) that raising plants in nutrient solutions will not produce results much different from raising plants in soil, but that the use of hormones in addition to the nutrients may produce incredible results, (5) that it requires correct procedure, skill, patience, and ability to improvise and solve the unexpected problems in order to conduct such experiments.

THE FOLLOWING list of learning activities was compiled from suggestions made by the members of the participating groups.

I. *The mineral needs of plants*

1. The amount of minerals used by the plant from the nutrient solution is very small in comparison with the total amount of food used by the plant.
2. The plant requires thirteen or more elements to make up its food.
3. The plant is able to absorb some elements in excess of its need without harm.
4. Each element performs a specific function in building plant tissues.
5. The kind and amount of nutrient required by the plant varies according to the physical condition under which it is grown.

II. *Processes employed by the plant*

1. Plants take minerals, water, and some air through their roots.
2. Plants transport nutrients from their roots to the leaves and stems where photosynthesis occurs.
3. Photosynthesis is possible only in the presence of light and chlorophyll. Certain mineral elements are needed to enable the plant to produce chlorophyll. Some of these elements are absorbed through the roots.
4. Plants make use of diffusion, osmosis, and capillarity in taking nutrients.

III. *Physical and chemical conditions affecting plant growth.*

1. The humidity of the atmosphere affects the rate of transpiration and the subsequent rate of absorption of water from the solutions by the roots.

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*Now available from the author for 35¢.

2. The temperature of the atmosphere affects the rate of growth.
3. Light is the essential source of energy for plants. All plants do not require the same amount of light.
4. The light supply of the plant may be artificially supplemented.
5. The growth and normal functioning of the plant is closely associated with the acid-base balance of ions in the nutrient solution.

IV. *Many disorders result from improper growing conditions.*

1. Toxic conditions result from an excess of certain elements.
2. Retarded growth results from inadequate supply of heat, water, light, or food.
3. Photosynthesis cannot occur without adequate light.
4. Abnormal conditions result from inadequate supply of air to the roots.

V. *Broader principles and applications the work suggested.*

1. Selective absorption of plant foods from the solutions.
2. Mineral requirements may differ for plants of different species.
3. Basic relationship between soil and crop production.
4. Possibility of growing plants under ideal conditions.
5. Possibility of using nutrient solutions on a commercial scale or in producing greenhouse vegetables.

THE PROJECT was conducted throughout the fall term. The evaluation which was originally planned by the group proved to be an agreeable task since this had been an instance in which the pupils had learned by doing. Group B won the contest. This was largely due to the efforts of two groups which conducted many additional experiments with the hormones. The pupils seemed to realize that the good results they had obtained had come from careful planning, hard work, and supplying the plants with the food and other necessary growing conditions. The idea of raising "mineralized vegetables", "Super crops", and obtaining "miraculous results" by using nutrient solutions was thoroughly dispelled.

POSTWAR PROBLEMS

Continued from Page 17

to predict or foresee much that will take place in research within the next several years. Therefore, I must treat this analysis of all potential resources by discussing the creative ability inherent in our youthful scientists of tomorrow. The development of new laboratory techniques, and new products will open a new world to us. The extent of this development will be dependent on the kind of instruction you give in the classroom, and the opportunities you provide the young men and women with a natural aptitude for science to carry on research within your laboratory. We should rightfully ask ourselves this question:

> "Shall the program of pure research be left entirely to the scientists of the higher institutions of learning and to the scientists of the industrial laboratory; or should we plan a program of secondary science instruction and equipment that will be flexible enough to permit scientifically minded students to carry on research?"

ONE OF THE most invigorating movements in the promotion of a greater interest in science education has been carried on by Science Service, through the organization of some five thousand science clubs in the country. No one person can possibly measure the results of the activity in our high schools of today. Certainly any efforts expended by them and by the sponsors of each club, to develop the inherent interest in science will more than justify itself in the kind of scientist we shall find in our laboratories tomorrow.

Each year, it is our pleasure to participate in the making of $11,000 in scholarship awards to students particularly gifted in science. These students of science were discovered in your classroom, and they are encouraged to develop their special talents. They are ready for the challenge of the future and are prepared to take up the unfinished business of solving some of the world's problems.

THE STUDENT scientists of today are the human resources who will carry on the program of creating new power for our use tomorrow. More than ever before we need to

Continued on Page 48

EDUCATION FOR YOUTH

Continued from Page 11

either for entry to the upper years of college or pursue terminal courses leading directly to employment in a variety of occupations. This latter type of program is especially needed in my own field in this country to supply the personnel for positions auxiliary to professional engineering, such as surveying, drafting, minor designing production, supervision, and the like. If community institutes could be established in urban industrial communities able to sustain them soundly, professional engineering education would be relieved of a good deal of its present inappropriate burden of supplying personnel to industries for subprofessional technical occupations. I am not sure, however, that the program proposed for Grades XIII and XIV of the community institute fit this purpose as well as they might. I fear, also, that the proposed junior college program of Grades XIII and XIV will not provide the equivalent of the first two years of college curricula in engineering and science, as they are now constituted.

I say this because I think a reasonable doubt can be expressed as to whether in an average of four hours per day for (presumably) five days per week, adequate training can be given for vocational preparation in terminal courses, or for the study of sciences, mathematics, social studies, literature, and foreign languages in advanced collegiate courses. The graduate of the community institute program will, I think, require three more years to complete an engineering curriculum in the leading technical schools and universities. But these questions will, I hope, become matters of adjustment; the proposal for the establishment of the institutes which will serve the purpose of the preliminary stages of advanced education to the young people where they can pursue it, is essentially sound, and the money should be found to establish them wherever feasible. And, of the utmost importance, where qualified teachers can be found to staff them.

I find it difficult to appraise accurately the recommendations of "Education for All American Youth" as to preparation for higher education for the reason that the statements of

the document are not sufficiently explicit, at least for my method of appraisal. Provisions for science and mathematics are lumped together with other studies, including languages and social studies, which make it difficult to evaluate them individually. In analyzing these provisions, I have endeavored to express the course provisions of the two secondary schools described in comparison with those of the general run of entrance requirements to accredited engineering curricula. I have employed the commonly used college entrance unit, though in doing this, I am conscious of some indiscretion in doing so in view of the criticism leveled at this sort of educational bookkeeping. I may say at this point, parenthetically, that I am in sympathy with those who advocate the use of more valid measures of ability, aptitude, and achievement than the customary type of entrance credits as a means of selecting students of scinece or engineering. For the moment, however, reduction to those terms is the only means available, aside from using a wholly uncertain interpretation of discussions of these matters in the text.

The general run of the stronger Eastern engineering colleges specify from 8 to 11 of the 15 units required for admission to engineering about as follows:

Mathematics	3 to 4 units
English	3 units
Sciences (Physics and Chemistry)	1 or 2 units
History	1 or 2 units
Foreign Languages	0
	8 to 11 units

These units are commonly specified for Grades IX to XII inclusive; from 6 to 9 of them would be pursued in Grades X to XII, inclusive.

So far as I can analyze, or perhaps interpret would be a better term, the college preparatory programs of the two schools of the text up to and including Grade XII, and including every item that could, in my opinion, be considered as valid college preparatory work, the following provisions are made as preparation for engineering in Grades X to XII, inclusive:

Farmville Secondary School	6 Units
American City Secondary School	8 Units

From these totals I have excluded the general course in science which is designated as "methods, principles, and facts needed by all students" because this work appears to be in the nature of a general survey course which, while possibly having value for some high school students would promise very little in the way of valid preparation for the quantitative study of a particular science in college. And I have also excluded the course in "common learnings" which is given such prominence in the document, for the reason that it seems, so far as one can judge from the description, to offer little if anything in the way of preparation for the study of engineering or science.

It appears, therefore, that if all of the provisions that might be considered as of direct value in preparation for work at college level, including the course designated as "remedial" in the field of mathematics and English and the time devoted to "individual interests," and assuming that individual students would elect suitable college preparatory courses throughout their secondary school careers, these provisions would be definitely on the low side of normal engineering college requirements. Of course, a major factor in relation to the question I am here considering would be the quality of instruction and standards of performance that would be maintained. Whether the courses in mathematics would involve problems other than those that could be solved be imitative methods, the quantitative nature of the work in science, and the whole regime of study and work habits would also be controlling factors in establishing the adequacy of preparation for college careers in professional pursuit.

I confess, in general, to a strong feeling of apprehension and disappointment in studying this document chiefly on two grounds: one that the provisions for preparation in science and engineering are not more explicitly stated and that they seem to be distinctly on the lean side of college preparatory provisions; and the other that so much emphasis is given to general courses such as "common learnings"

to be pursued by all students to help them "grow in competence as citizens—; in understanding of economic processes and of their role as producers and consumers; in cooperative living in family, school and community; in appreciation of literature and the arts; and in the use of the English language." It is my chief fear, in reading the document that the substitution of such broadly inclusive and generalized survey-type material as this for the specific study of individualized courses in science, mathematics, or other subjects requiring bare intellectual efforts may result in a smattering of a great deal and mastery of little or nothing. In other words, I fear that appreciation has largely taken the place of scholarship. And I confess that I am old fashioned enough to believe in the latter in the professions and elsewhere too.

I have hoped for the past many years that a statement might emanate from those who guide the destinies of secondary education that more adequate provision might be made in this country for sound work preparatory to the sciences, engineering, and the other professions. I fear that a great opportunity has been lost by those who prepared the document under discussion to make adequate provision in the secondary schools for the basic preparation of the future scientists and engineers who are destined to exercise a major share of the responsibilities of shaping the course of the social and economic developments of this country in the future.

THIS AND THAT

Continued from Page 14

Otis W. Caldwell.
Ellsworth Obourn.
Donald Kumro.
Brother Josephs.

Professional Relations

Leo J. Fitzpatrick, Ch.
Reuben T. Shaw.
Greta Oppe
Hanor Webb
Rachael Anderson.
R. Will Burnett.

Resolutions

Laurence L. Quill, Ch.
Merl A. Russell
Deborah Russell.

Budget

Hugh Muldoon, Ch.
Norman R. D. Jones.

Consumer Science

Nathan A. Neal, Ch.
George Jeffers.
Morris Meister
Phillip G. Johnson.

Public Relations

Reuben T. Shaw, Ch.
Leo J. Fitzpatrick
Greta Oppe.
Hanor Webb.
Rachael Anderson.
R. Will Burnett.

Yearbook

Dwight Sollberger, Ch.
John C. Hogg
Maurice Ames.

Auditing

W. H. Michener, Ch.
Paul R. Young.

Membership

Norman R. D. Jones, Ch.
W. Bayard Buckham.
Fred W. Moore.
Greta Oppe.
Ethel Ramsden.

EUGENICS, GENETICS AND RACE

Continued from Page 25

tion and discovery, such a flowering of intellectual development, as the world has never before seen. And all this, presumably, as a sort of efflorescence of the process of deterioration! The swan song, perhaps, of a world the eugenist never made. Or have the great achievements of the last hundred years been due, perhaps, to the genius of a few individuals who have managed to carry the burden of the mediocrities along with them? This is a view which is frequently urged by superior persons. It does scant justice to millions of individuals who were never given a

chance and who made good as best they knew how, which was more often than not as best they were permitted.

Let us give human beings equal social, cultural, and economic opportunities, and then we shall be able to judge how many, if any, genetically inadequate individuals we have among us.

We would then be in some kind of a position to judge the nature of the biological measures which ought to be taken to insure the welfare of our species. Would this not seem the most reasonable procedure in view of the fact that it would take many hundreds of years to eliminate, even partially, a single defective character? By purely social procedures it would take but a few generations to determine whether or not many of the alleged deteriorative factors, which are said to be undermining the health of the race, could be eliminated by improvements in the socialenvironment. Our present social ills are for the most part produced not by genetically inadequate individuals, but by socially inadequate ones, and the remedy for those ills lies in the social and not in the genetic improvement of our species.

Genetists Findings not Applicable

THE GREAT fallacy committed by eugenists, and by many others, is that having to some extent followed the works of the geneticists in the breeding of certain characters in lower animals within the walls of a laboratory, they have extrapolated from the laboratory findings on such lower animals to conditions vastly more complex and obscure, and which, moreover, have never formed the subject of experimental investigation. Human beings are not representative of strains similar to the highly selected pure strains of mice or rabbits which form the geneticist's material. Naive and uninformed thinkers believe that if, in a geneticist's laboratory, the genetics of a certain character is studied, and the experimenter can at will breed his animals for that character, the same thing can be done for human beings. Theoretically and under certain ideal conditions, and given scores of

generations of selected human beings, this could be done for some but not for all characters. Obviously, this is quite impractical. Even were it practical, it would still be open to some question whether it would be desirable. We frankly confess to not being in possession of all the answers. The truth is that we do not yet know sufficient about human heredity to meddle with human beings with a view to "improving" the stock. Two mediocrities may produce a g e n i u s; two geniuses may produce a mediocrity. Because undesirable characters are usually recessive it is generally impossible to spot them in normal individuals, and it is therefore impossible to predict when they are liable to crop out. Selective breeding is inbreeding, and that is a notoriously dangerous process, for by such means we g r e a t l y increase the chances for bringing together recessives of a character detrimental to the organism. By outbreeding, such recessives become associated with dominants and therefore remain unexpressed. When selection is practiced on animals we select for a particular character, and keep only those animals which exhibit it. The others showing undesirable recessivve characters are killed off. Mankind, it is very much to be feared, is not only to be saved by being treated like a breed of racehorses or a strain of dogs, at the fnacier's discretion. Human beings require to be treated as human beings first, and only secondarily, if at all, as if they were animals, for the ills from which our particular sample of mankind suffer were created in virtue of man's capacities as a human being, and not by the irrelevant fact of his being an animal subject to the laws of genetics as in any other animal.

In conclusion, then, it seems evident that until man has put his social house in order, by means similar to those which have produced its present state of disorder, it were unwise for him to indulge in any strenuous biological exercises for the shaky fundament of a rickety house is not the place for them.?

CONSERVATION

Continued from Page 27

Check lists on pamphlet vocabulary, pamphlet ideas, and pamphlet readability.

Teacher-student conferences on pamphlet material, attitudes and opinions on forest destruction and conservation, and forestry vocations.

Report blanks to secure student estimates of pamphlet concepts as applied to the students' own communities. Direct quotations from student papers show that the ideas and concepts of the pamphlet are important because:

"Too many people want to cover ground with buildings instead of growing trees; we use forests products and we need forests to control floods; we need to know the harm done by insects, disease and man; forests managed properly make more jobs; forest conservation begins at home; we have forested parks and wildlife, to protect; the city is dependent upon the farm and forest; we are in an agricultural region; trees make a community more beautiful; we have forest industries, we must no longer be wasteful; *we students will be future law-makers and forest growers.*"

THE VARIED techniques employed in the teaching of *Forests and Man* have proved not only successful teaching and evaluation devices but render American forests and their conservation more dynamic, more appealing, and vastly more important in the life of the high school student. He becomes aware of the fact that national and state problems may also become his own community problems. His study and creative endeavors in the classroom may enable him to cope more intelligently with these problems as he matures.

CRYSTALS

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(7) Sodium uranyl acetate—$Na(C_2H_3O_2)\cdot UO_2(C_2H_3O_2)_2$—from potassium chloride and uranyl acetate, acidified with acetic acid. Rectangular yellow triangular plates or regular tetrahedra, appearing black under transmitted light.

(8) Potassium uranyl acetate—$K(C_2H_3O_2)$

$\cdot UO_2(C_2H_3O_2)_2$ — from potassium chloride and uranyl acetate, acidified with acetic acid. Clusters of needles.

(9) Sodium oxalate—$Na_2C_2O_4$—from sodium chloride and oxalic acid. Colorless, irregular needles.

(10) Ammonium oxalate — $(NH_4)_2C_2O_4$ — from ammonium chloride and oxalic acid. Colorless thin rhombic prisms.

(11) Mercurous chromate—Hg_2CrO_4—from mercurous chloride and potassium bichromate, acidified with nitric acid. Small, red skeleton crosses and chain-like aggregates.

(12) Calcium sulfate—$CaSO_4$—from calcium chloride and sulfuric acid. Slender, colorless needles, in X's or bundles.

(13) Calcium oxalate — CaC_2O_4 — from calcium chloride and oxalic acid. Tetragonal octahedra, crosses or tablets.

(14) Barium oxalate—BaC_2O_4—from barium chloride and oxalic acid. Aggregates or sheaf-like masses.

(15) Calcium tartrate — $CaC_4H_4O_6 \cdot 4H_2O$— from calcium chloride, sodium tartrate and tartaric acid. Colorless orthorhombic prisms with semi-truncated ends.

(16) Zinc and sodium carbonate—a double salt from zinc chloride and sodium bicarbonate. Colorless triangular plates, or isotropic tetrahedra.

ALL OF THE reactions described here may be made with chemicals usually found in the high school laboratory. For those students desiring additional work, or for expanded project work, many other reactions may be investigated, such as rubidium salts and chloroplatinic acid, cesium and chlorostannic acid, barium and potassium ferrocyanide, and aluminum and ammonium paramolybdate.

The reactions were selected to give the students the opportunity to form and view as many of the characteristic crystal types as possible. Results were uniformly good, and much interest was aroused. Laboratory reports were made on the experiments by each student.

BOOK SHELF

DEMONSTRATIONS AND LABORATORY EXPERIENCES IN THE SCIENCE OF AERONAUTICS. McGraw-Hill Book Company, 1945. 155 pp. 21x28 cm. 209 illus. $2.00.

This book was prepared with the cooperation of the Civil Aeronautics Administration and the American Council on Education and represents the contributions of many teachers. It supplies a wealth of teaching demonstrations and experiences such as any teacher of aeronautics would desire in this area.

The demonstrations make use of inexpensive, simple and easily available materials. They do not require any special skills and may be made with the usual tools that the average person may have.

The areas covered in the book include aerodynamics, power plants, meteorology, navigation, and communications.

Every teacher of aeronautics should have a copy of this book.

MAGNETRON OSCILLATOR FOR INSTRUCTION AND RESEARCH IN MICROWAVE TECHNIQUES. J. Tykocinski Tykociner, Research Professor of Electrical Engineering; and Louis R. Bloom, Research Assistant, University of Illinois. University of Illinois Engineering Experiment Station Circular Series No. 48. Published by the University of Illinois. 30 pp. 15x23 cm. Illus. $.40.

The booklet discusses the development and construction of magnetron tubes and their characteristics. The oscillator is coupled to a radiating system. General operating requirements and procedures are given. The booklet is of special value to those interested in research in this area.

TO LIVE IN HEALTH. R. Will Burnett, Stanford University. Silver Burdett Company, 1944. 332 pp. 15x23 cm. Illus.

Presented in non-technical language, shorn of unnecessary terminology *To Live in Health* is a very readable presentation of the facts related to health of the individual. It presents a view of the whole health problem and gives an analysis of types of knowledge, attitudes and insights needed to meet it. Further it provides a study of the body parts involved in the maintenance of health so that the indiivdual may deal with the problems intelligently.

COPPER. June M. Metcalfe. The Viking Press, New York, 1944. 104 pp. 14x22 cm. Illus. $2.00.

This book tells the story of copper very interestingly all the way from the past ages through the present processes of mining and manufacturing. It gives many interesting uses. The illustrations are very good.

MEN OF SCIENCE IN AMERICA, Bernard Jaffee. Simon & Schuster, 1944, 600 pp., $3.75.

This fascinating book again confirms Jaffe in the category of biographer and historian. In portraying the lives and works of important men of science in America, Jaffe maintains an awareness of the moving historical events in the growth of this great nation, and repeatedly identifies the work and progress of science with the social, political and economic stresses of the times. While each of nineteen chapters, packed with thrill and excitement, is centered about the contributions of a great scientist, the work of innumerable contemporaries are so interwoven as to establish this as both a source book and a thriller. The twentieth and concluding chapter points to social problems resulting from technology, and indicates the obligation of the scientist and engineer to recognize his peculiar social responsibilities. Jaffe's *Men of Science in America* is unquestionably a high priority book not only for the science teacher but also for the school library.—J. S.

TELESCOPES AND ACCESSORIES, George S. Dimitroff, Ph. D., J. G. Baker, Ph. D., Harvard College Observatory. 182 illustrations, 309 pp. Blakiston, 1945, $2.50.

Following a brief discussion of visual telescopes, the book presents an interesting description of various aspects of photography in relation to telescope construction and accessories. Technique in spectroscopy and heliotropy is discussed. *Telescopes and Accessories* is profusely and attractively illustrated. It is written to provide pleasurable and profitable reading for both the student and teacher of science as well as for the amateur astronomer.

THE STORY OF BLUE CROSS, Louis H. Pink. Public Affairs committee, New York City. 1945. 31 pp., 10c.

Extensive interest in so-called Blue Cross plans for prepared medical service is testimony to increasing desire for this type of security. Benefits are, to date, almost entirely confined to hospital service; but Mr. Pink points out the need for broader protection to include preventive medicine, doctor service and diagnostic service. There is need, however, for cooperation on the part of organized medicine. Mr. Pink is ready to compromise to the extent of satisfying their demands, but he does not point out that organized medicine actually has vigorously fought and opposed group medicine plans.—J. S.

POSTWAR PROBLEMS

Continued from Page 36

develop the kind of instruction that will help our students to learn by doing within the school laboratory. Science used correctly will provide us all of the resources for present and future consumption we can use. Science misused will destroy all available resources and make no provision for the creation of new resources.

The horizon of tomorrow is full of unlimited opportunities and challenging problems for any mentally alert teacher who has vision enough to look beyond the walls of his classroom. What you do with these problems will be conditioned by your objective outlook. They can be a "headache", or they can be a "tonic" if your mental alertness has reached an acumen that will enable you to select and use properly the available resources of current information and "up-to-the-minute" laboratory procedures.